Joe P. F.Y.I.

Ministry
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Environment
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STANDARDS DEVELOPMENT BRANCH OMOE
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Progress Report No. 2

Waste Site Identification Study

Phase II, Part II
Verification Studies
March 4, 1982

West Central Region

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Progress report no.2 : waste site
identification study phase II,
part II verification studies.
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9-0913

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March 4, 1982

Project No. 9-0913

Mr. Les A. Ficzere, P. Eng.
Waste Management Branch
Ministry of the Environment
135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

Dear Les:

Re: Progress Report No. 2
Site Verification Study

We are pleased to submit five (5) copies of our second progress report on the Phase II, Part II of Waste Site Identification Study (Verification Study) for the West Central Region. This report presents the results of the water and gas analysis to date and outlines future work activities.

Should you have any questions on this report, please do not hesitate to contact us.

Yours very truly,

CONESTOGA-ROVERS & ASSOCIATES LIMITED

Anthony J. Crutcher, P. Eng.

AJC/mm
Encl.

c.c. Study Committee

TABLE OF CONTENTS

Page

1.0 INTRODUCTION 1

2.0 SITE NO. 0044 - THOROLD 4

- 2.1 FIELD INVESTIGATION 4
- 2.2 HYDROLOGY 6
- 2.3 WATER QUALITY 8
- 2.4 COMBUSTIBLE GAS MONITORING 11
- 2.5 SUMMARY OF FUTURE WORK PROGRAM 15

3.0 SITE NO. 0084 - WATERLOO 17

- 3.1 FIELD INVESTIGATION 17
- 3.2 HYDROLOGY 17
- 3.3 WATER QUALITY 22
- 3.4 COMBUSTIBLE GAS 23
- 3.5 SUMMARY AND FUTURE WORK PROGRAM 25

4.0 SUMMARY 27

APPENDIX A BOREHOLE LOGS FROM GAS-POWERED PORTABLE AUGER

LIST OF FIGURES

Page

FIGURE 1.1 KEY MAP - WASTE SITE IDENTIFICATION STUDY 2

FIGURE 2.1 LOCATION OF SITE NO. 0044 WASTE SITE IDENTIFICATION STUDY 5

FIGURE 3.1 LOCATION OF SITE NO. 0084 WASTE SITE IDENTIFICATION STUDY 18

LIST OF TABLES

TABLE 2.1 WATER LEVELS 7
TABLE 2.2 WATER QUALITY ANALYSIS 9
TABLE 2.3 WATER QUALITY ANALYSIS 10
TABLE 2.4 COMBUSTIBLE GAS LEVELS 12
TABLE 3.1 WATER LEVELS 19
TABLE 3.2 WATER QUALITY ANALYSIS 20
TABLE 3.3 WATER QUALITY ANALYSIS 21
TABLE 3.4 COMBUSTIBLE GAS LEVELS 24

1.0 INTRODUCTION

This is the second progress report on the Ministry of Environment's Phase II, Part II of the Waste Site Identification Study (Verification Studies) for the West Central Region. The study includes three sites in the West Central Region, namely: Site No. 0044-Thorold, Site No. 0062-Grimsby and Site No. 0084-Waterloo. Figure 1.1 locates the sites on a Key Map. The schedule of work and program are detailed in the proposal prepared by Conestoga-Rovers & Associates Limited for this study, dated June 26, 1981. On July 31, 1981 Conestoga-Rovers & Associates Limited were authorized to proceed with the work program.

On November 10, 1981 the first progress report was presented to the Ministry of the Environment. This progress report outlined the field investigation program, the installation of the monitors for water and gas at each site, presented the initial results of the water and gas analysis and detailed future work activities. This second progress report updates the field investigation program, presents the cumulative results of the water and gas analysis, and outlines remaining work activities.

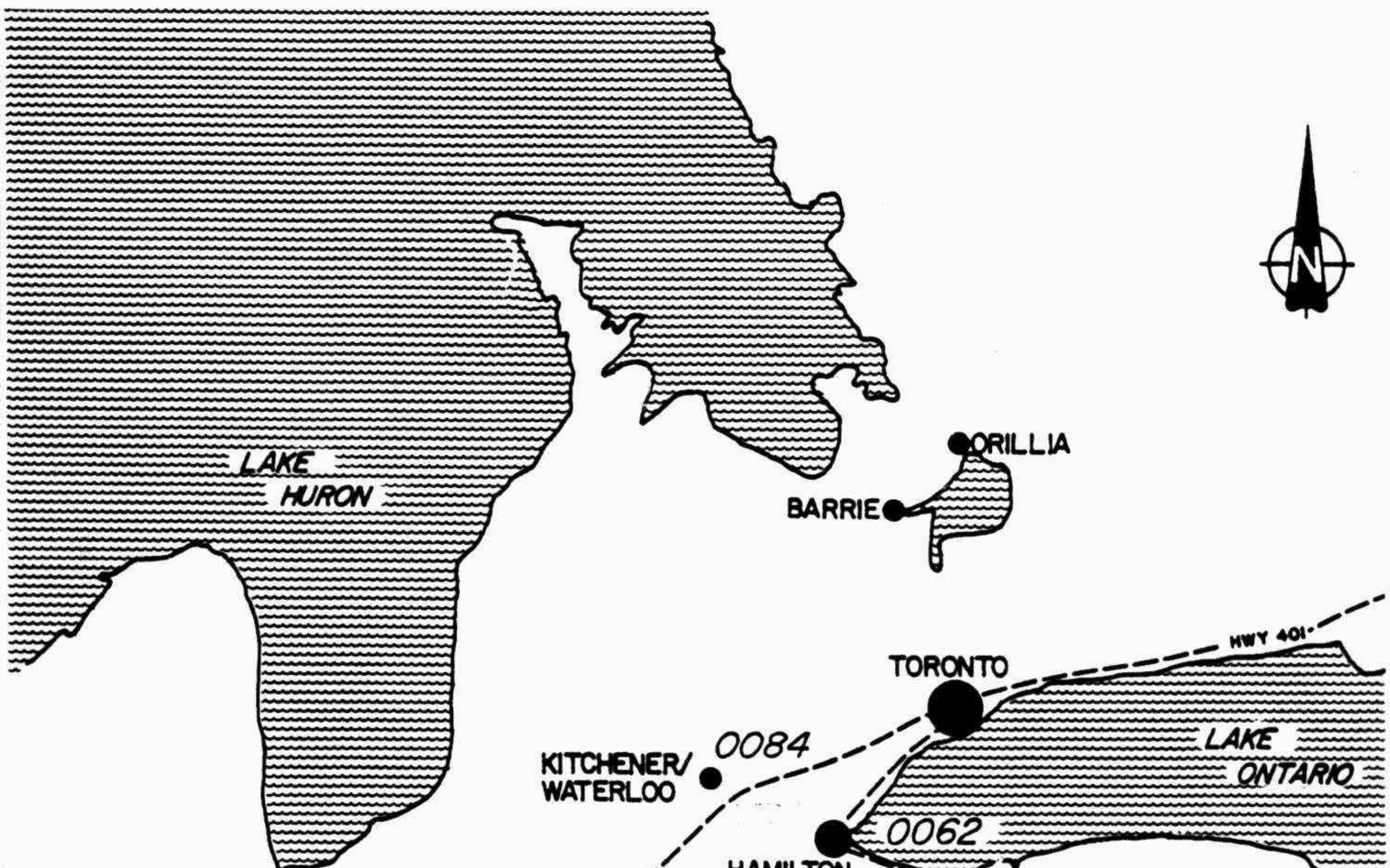

figure 1.1

KEY MAP
WASTE SITE IDENTIFICATION STUDY
Verification Studies

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The three sites to be investigated in Phase II, Part II of the Waste Site Identification program were Site No. 0044-Thorold, Site No. 0062-Grimsby and Site No. 0084-Waterloo. Investigation has been discontinued at the Grimsby site as recommended in progress report number one.

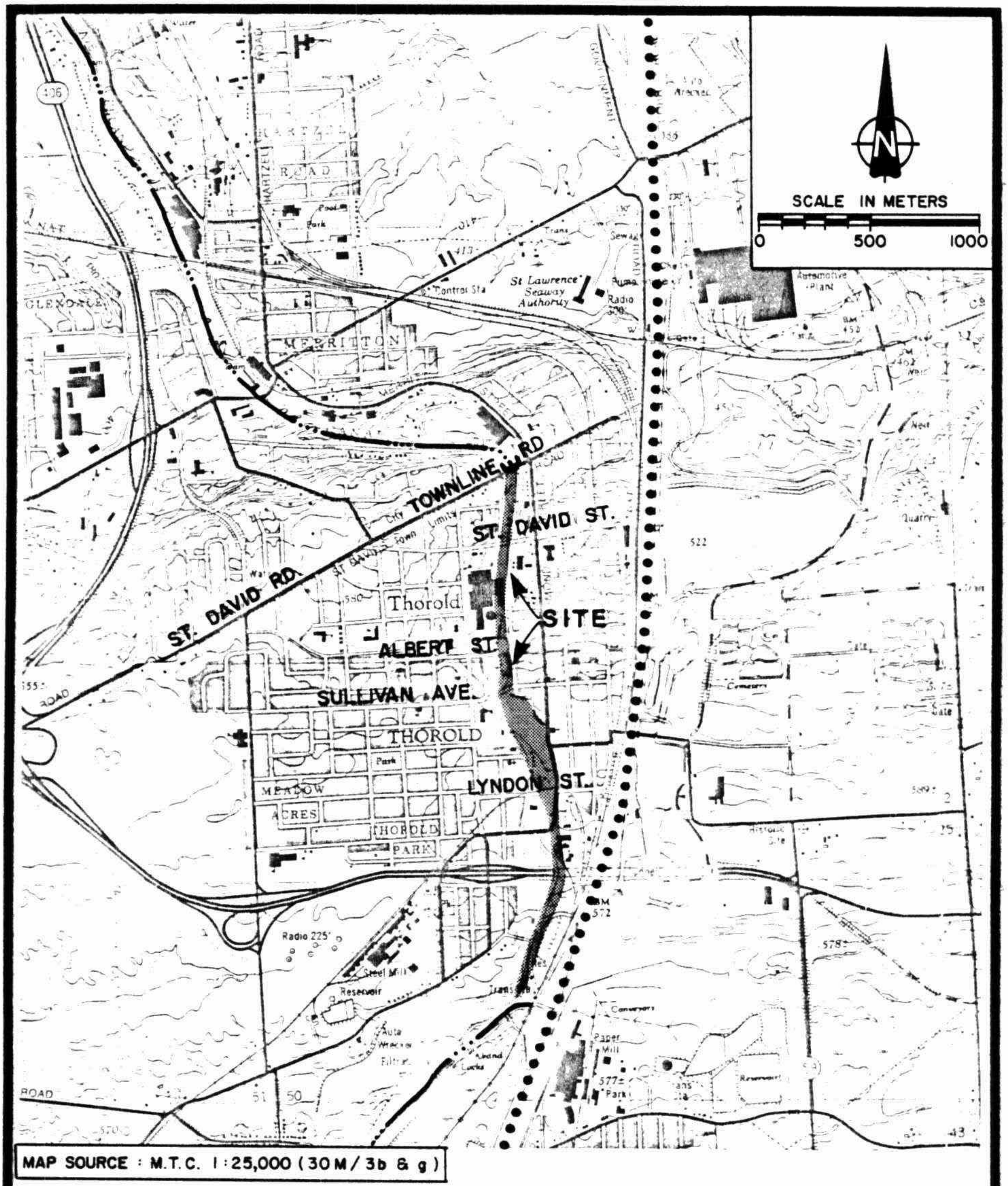
The field investigation at both the Thorold and Waterloo sites has consisted of regular monitoring for combustible gas and groundwater levels on a monthly basis, and monitoring the groundwater chemistry a total of three times on a four month schedule.

2.0 SITE NO. 0044 - THOROLD

2.1 FIELD INVESTIGATION

The initial field investigation of this study was restricted to the section of the old Welland Canal between Lyndon Street and Sullivan Avenue shown on Map 2.1. As outlined in progress report number one it was recommended that due to high values of combustible gas being detected in the area of investigation, the field investigation should be expanded along other sections of the buried canal where putrescible waste could be expected to be present. Subsequently the area of investigation was extended for the full length of the old Welland Canal through the City of Thorold. The expanded limit of investigation is shown in Figure 2.1. Areas along the filled old Welland Canal that possibly contained putrescible materials were located with the information from personal interviews of local residents and municipal officials.

On November 18, 1981 a gas-powered portable auger with 5 cm diameter augers was used to drill an additional 17 boreholes along the canal to a maximum depth of 1.5 m as located on Map 2.2. Boreholes were placed along the canal channel and at the foundation of buildings on or immediately adjacent



MAP SOURCE : M.T.C. 1:25,000 (30 M/3b & g)

LEGEND

····——··· OLD WELLAND CANAL — OPEN WATER

●●●●●●●NEW WELLAND CANAL

figure 2.1

LOCATION OF SITE Nº 0044
WASTE SITE IDENTIFICATION STUDY
Ministry of the Environment

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to the canal. The description of fill encountered is presented in Appendix A. A gas monitoring probe was installed in each borehole (GMP9-81 to GMP25-81). Each gas probe was 1.3 cm diameter PVC pipe with a screen 0.6 meters long of drilled pipe wrapped with polypropylene filter cloth. The borehole was backfilled with native material. The gas monitoring probes locations are presented on Map 2.1 and 2.2. The first progress report of the Waste Identification Study describes the installation of GMP1-81 to GMP8-81 and OW1-81 to OW4-81.

The total 25 gas monitoring probes and 4 observation wells has been monitored monthly since their installation for combustible gas and water levels respectively. The observation wells have also been sampled twice for water quality.

2.2 HYDROLOGY

Groundwater levels for the observation wells in Battle of Beaverdams Park are presented in Table 2.1. The water levels have shown inconsistent fluctuation during the five month monitoring period. The water levels in OW1-81 and OW2-81 varied by 1.9 and 1.1 meters respectively, and

TABLE 2.1

WATER LEVELS

Sample Location	Ground Elevation (m AMSL)	Monitoring Date (Water elevation meter AMSL)					
		Sept. 15 1981	Oct. 27 1981	Nov. 17 1981	Dec. 15 1981	Jan. 14 1982	Feb. 11 1982
OW1-81	176.47	170.855	169.710	171.526	169.979	170.053	169.611
OW2-81	173.32	168.431	169.191	169.119	168.792	168.817	168.122
OW3-81	172.04	167.693	167.708	167.758	167.716	167.661	167.564
OW4-81	176.09	169.542	169.547	--	169.536	169.584	169.425

the water levels in OW3-81 and OW4-81 varied by 0.2 meters. The maximum groundwater elevation was recorded in November 1981 and the minimum level was recorded in February 1982.

2.3 WATER QUALITY

Each observation well was bailed for 1-1/2 well volumes and then sampled and analysed for major ions, phenol, total iron and COD. The sources for surface water samples were frozen at the time of sampling.

The water quality data is presented in Table 2.2 and Table 2.3 for sampling periods September 15, 1981 and February 11, 1982 respectively.

In general there is an improvement in the water quality. The improvement in water quality from the October 5, 1981 monitoring to the February 2, 1982 monitoring would be indicative of the well not being equilibrated. Notably there has been a significant change in the sulphate reading in OW1-81 decreasing from 210 mg/L to less to than 1 mg/L. Likewise the COD readings for all the wells have

TABLE 2.2

WATER QUALITY ANALYSIS

MONITORING LOCATION September 15/81	Calcium as Ca	Magnesium as Mg (calculated)	Sodium as Na	Potassium as K	Alkalinity as $CaCo_3$	Sulphate as SO_4	Chloride as Cl	Hardness as $CaCO_3$	pH	Conductivity µmhos/cm	Iron as Fe	COD	Phenols (ppb)
OW1-81	328	105	96	42	1060	210	200	1250	8.0	2700	1.2	260	51
OW2-81	92	25	48	9.7	189	51	100	331	7.9	850	<0.01	227	40
OW3-81	360	126	131	14	1120	170	290	1420	7.5	2500	0.79	153	10
OW4-81	300	66	84	7.6	1020	7	159	1020	7.5	2000	0.40	274	44
SP1-81	40	8	9.8	1.5	102	27	24	133	8.1	340	<0.01	<25	20
SP2-81	50	5	33	2.6	100	86	30	145	7.2	410	0.07	160	6

Note: All analysis conducted by Conestoga-Rovers & Associates Limited except Phenols which was analysed by Beak Consultants. All results reported in mg/l unless noted.

TABLE 2.3

WATER QUALITY ANALYSIS

MONITORING LOCATION FEBRUARY 11/82	Calcium as Ca	Magnesium as Mg (calculated)	Sodium as Na	Potassium as K	Alkalinity as $CaCo_3$	Sulphate as SO_4	Chloride as Cl	Hardness as $CaCO_3$	pH	Conductivity µmhos/cm	Iron as Fe	COD	Phenols (ppb)
OW1-81	270	79	54	19	1190	< 1	71	1000	7.1	2000	1.6	80	63
OW2-81	78	19	18	6.5	285	5	38	270	7.7	620	0.22	<25	3
OW3-81	177	87	40	5.5	639	290	89	800	7.3	1620	0.38	<25	72
OW4-81	244	94	42	5.8	950	< 1	141	995	6.7	1900	4.9	<25	28
SP1-81 Frozen													
SP2-81 Frozen													

Note: All analysis conducted by Conestoga-Rovers & Associates Limited
except Phenols which was analysed by Beak Consultants.
All results reported in mg/l unless noted.

decreased, OW1-81 having a COD of 80 mg/L with the remaining COD's being less than 25 mg/L. Phenols have generally increased with the maximum phenol reading of 72 ppb at OW3-81.

A more comprehensive review of the chemical analysis will be conducted after the third set of sampling has been completed and the determination of equilibrium conditions within the well.

2.4 COMBUSTIBLE GAS MONITORING

Eight gas probes (GMP1-81 to GMP8-81) are located in the Battle of Beaverdams Park, and eight (8) additional gas probes (GMP11-81 to GMP18-81) are located along the periphery of the park and usually adjacent to a building foundation. The remaining 9 gas probes (GMP9-81, GMP10-81, GMP19-81 to GMP25-81) are situated along other sections of the buried Welland Canal. The gas probe locations are shown on Map 2.1 and Map 2.2.

Table 2.4 presents the results of the combustible gas monitoring to date. The combustible gas readings for September 15, 1981 are regarded as anomalous and subsequent readings are

TABLE 2.4

COMBUSTIBLE GAS LEVELS

Sample Location	Monitoring Date (% Volume Methane) Sept. 15 1981	Oct. 27 1981	Nov. 5 1981	Nov. 17 1981	Dec. 15 1981	Jan. 14 1982	Feb. 11 1982
GMP1-81	0	65	68	77	77	74	49
GMP2-81	0	55	55	75	70	70	23
GMP3-81	0	72	68	84	77	65	67
GMP4-81	0	38	32	43	54	48	33
GMP5-81	0	65	60	74	54	52	33
GMP6-81	0	65	70	78	69	63	60
GMP7-81	0	55	30	51	70	36	24
GMP8-81	0	72	65	71	38	63	13
GMP9-81					0	0	0
GMP10-81					0	0	0
GMP11-81					0	0	0
GMP12-81					0	0	0
GMP13-81					0	0	0
GMP14-81					0	0	0
GMP15-81					0	0	0
GMP16-81					0	0	0
GMP17-81					0	0	0

TABLE 2.4 (cont'd)

COMBUSTIBLE GAS LEVELS

Sample Location	Monitoring Date (% Volume Methane)						
	Sept. 15 1981	Oct. 27 1981	Nov. 5 1981	Nov. 17 1981	Dec. 15 1981	Jan. 14 1982	Feb. 11 1982
GMP18-81					0	0	0
GMP19-81					0	0	0
GMP20-81					0	0	0
GMP21-81					0	0	0
GMP22-81					0	D	D
GMP23-81					0	0	0
GMP24-81					0	0	0
GMP25-81					0	0	0

D - Destroyed

GMP9-81 to GMP25-81 installed on November 18, 1981 considered as representative samples. The original eight gas probes (GMP1-81 to GMP8-81) indicate consistently high concentrations of methane gas. The values decreased for six of these gas probes on February 11, 1982. This may be related to the snow melt which started a few days prior to sampling. Ponded water was observed on the site and possibly water was collecting in the gas probes.

Combustible gas was monitored in the top of manholes and catch basins along the park, with none being detected. Monitoring for combustible gas at the gas vents around the Thorold Community Credit Union has indicated no combustible gas. However this could be attributed to the air circulation being too high to allow for a gas build-up.

After three monitoring intervals, no combustible gas has been detected at GMP9-81 to GMP25-81. The gas probes (GMP11-81 to GMP18-81) located along the periphery of the Battle of Beaverdams park suggest that putrescible waste was not deposited outside the old Welland Canal boundary. Also these gas probes indicate that lateral migration of methane from the park to adjacent property is not occurring at the sites which are being monitored.

The remaining nine gas probes along the old Welland Canal indicate that combustible gas is not present at the monitor locations.

2.5 SUMMARY OF FUTURE WORK PROGRAM

The final water samples for analysis of major chemistry and phenols will be collected in June 1982. Water level data will be compiled once each month up to that date.

The gas monitoring will be continued once per month.

The City of Thorold has been advised of the high proportions of methane in the Battle of Beaverdams Park. Conestoga-Rovers & Associates Limited have recently completed an investigation and a report for the City of Thorold outlining the potential extent of putrescible waste and methane generation along the old Welland Canal. Also, the report recommended a detailed field investigation program to define the extent and volume of putrescible waste and the presence of methane gas along the canal.

Particular emphasis of the investigation was placed at buildings on or immediately adjacent to the canal where putrescible wastes have been reported.

Recovery tests will be performed on the observation wells to estimate an insitu hydraulic conductivity. These results will be compiled with rates of infiltration to estimate leachate quantity and migration/attenuation.

3.0 SITE NO. 0084 - WATERLOO

3.1 FIELD INVESTIGATION

Figure 3.1 presents the site location and Map 3.1 presents the site plan. Nine observation wells and fourteen gas monitoring probes have been installed on the site as described in the first progress report.

Monitoring of groundwater and surface water levels and for combustible gas has been conducted on monthly intervals. The observation wells and the four surface water locations have been sampled twice to analyse for major ions, phenols, total iron and COD.

3.2 HYDROLOGY

The groundwater levels and water level for SP1-81 are shown in Table 3.1. Over the monitoring period, the water levels have decreased by an average of 0.25 meters, (typical of seasonal trends) with the maximum fluctuation at OW9-81 by 0.54 meters and the minimum fluctuation at OW7-81 by 0.08 meters. The highest water elevation was recorded in November 1981 and the lowest elevation was recorded in February 1982.

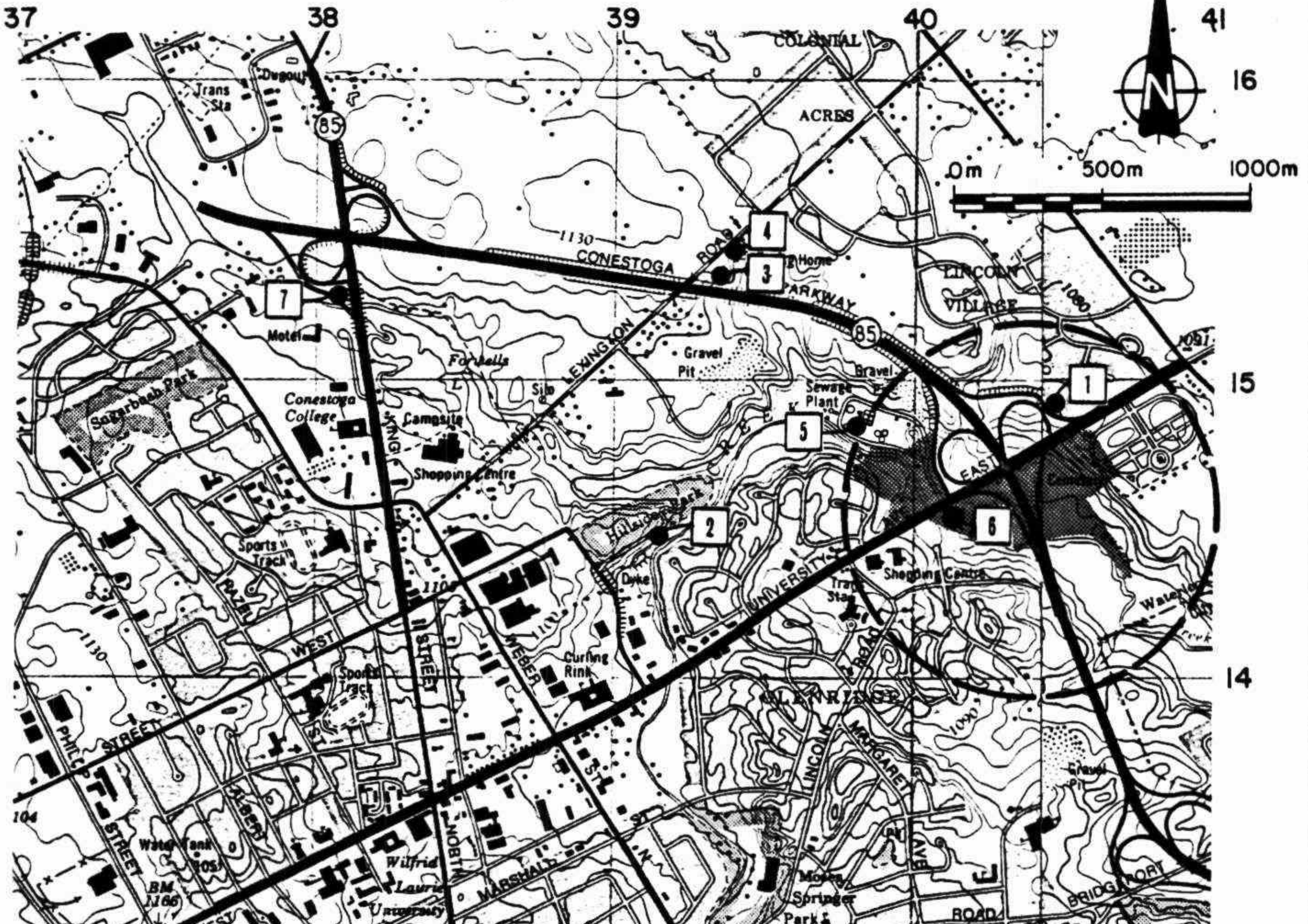

figure 3.1

LOCATION OF SITE Nº 0084
WASTE SITE IDENTIFICATION STUDY
Ministry of the Environment

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TABLE 3.1

WATER LEVELS

		Monitoring Dates (Water elevations in meters AMSL)				
Sample Location	Ground Elevation (m AMSL)	Oct. 5 1981	Nov. 7 1981	Dec. 8 1981	Jan. 8 1982	Feb. 2 1982
OW1-81	312.64	309.766	309.834	309.786	309.706	309.598
OW2-81	314.22	311.012	311.256	311.224	311.091	310.912
OW3-81	313.62	311.669	311.779	311.743	311.698	311.535
OW4-81	315.13	312.236	312.393	312.353	312.277	312.107
OW5-81	315.30	313.310	313.439	313.353	313.409	313.268
OW6-81	315.50	314.017	314.099	314.094	314.078	313.963
OW7-81	310.15	308.439	308.627	308.625	308.620	308.550
OW8-81	325.98	323.400	323.132	323.230	323.218	323.118
OW9-81	317.10	313.195	313.506	313.599	313.547	313.061
SP1-81 (Pond)	--	312.711	312.870	312.844	Frozen	Frozen

TABLE 3.2

WATER QUALITY ANALYSIS

MONITORING LOCATION October 5/81	Calcium as Ca	Magnesium as Mg (calculated)	Sodium as Na	Potassium as K	Alkalinity as $CaCo_3$	Sulphate as SO_4	Chloride as Cl	Hardness as $CaCO_3$	pH	Conductivity µmhos/cm	Iron as Fe	COD	Phenols (ppb)
OW1-81	220	38	213	17	635	18	475	705	7.0	2500	11.5	75	40
OW2-81	280	83	117	46	1150	255	140	1040	7.8	2500	2.7	200	22
OW3-81	236	19	91	15	700	65	178	669	7.3	1690	.51	200	9
OW4-81	368	40	79	27	670	580	128	1155	7.3	2300	.97	115	4
OW5-81	168	40	28	8.6	570	45	40	585	7.2	1150	.63	190	37
OW6-81	194	63	48	3.9	420	260	80	642	7.4	1290	.68	205	8
OW7-81	138	43	19	6.7	490	25	44	520	7.2	1010	.10	60	21
OW8-81	118	162	730	85	2920	<1	850	960	7.6	6800	.20	675	ND
OW9-81	118	55	48	7.8	212	240	70	520	7.9	1150	<0.01	75	7
SP1-81	96	23	73	9	220	80	74	336	8.3	1060	.11	<25	4
SP2-81	89	24	26	2.3	238	.75	60	320	8.2	1010	.01	<25	4
SP3-81	106	31	31	2.4	58	330	111	391	8.5	1550	.04	<25	5
SP4-81	166	15	33	6.3	535	3	30	475	7.5	960	0.03	<25	43

Note: All analysis conducted by Conestoga-Rovers & Associates Limited
except Phenols which was analysed by Beak Consultants.
All results reported in mg/l unless noted.

TABLE 3.3

WATER QUALITY ANALYSIS

MONITORING LOCATION FEBRUARY 2/82	Calcium as Ca	Magnesium as Mg (calculated)	Sodium as Na	Potassium as K	Alkalinity as $CaCo_3$	Sulphate as SO_4	Chloride as Cl	Hardness as $CaCO_3$	pH	Conductivity µmhos/cm	Iron as Fe	COD	Phenols (ppb)
OW1-81	160	44	154	15	640	<1	319	582	7.0	1950	18.0	60	12
OW2-81	200	108	85	43	1130	4	125	945	7.5	2500	0.36	285	14
OW3-81	220	36	76	16	750	2	160	700	7.4	1720	0.20	54	4
OW4-81	242	83	50	27	705	310	101	945	7.4	1920	0.40	54	8
OW5-81	164	32	29	3.7	530	39	46	540	7.3	990	2.1	<25	4
OW6-81	156	31	42	1.4	315	145	101	519	7.4	1020	0.18	<25	4
OW7-81	137	34	15	5.0	478	24	42	481	7.2	870	0.68	42	5
OW8-81	105	145	500	87	3050	4	850	858	7.7	6900	0.53	635	19
OW9-81	104	45	35	5.8	241	250	15	443	7.6	930	0.02	25	4
SP1-81 Frozen													
SP2-81 Frozen													
SP3-81 Frozen													
SP4-81 Frozen													

Note: All analysis conducted by Conestoga-Rovers & Associates Limited except Phenols which was analysed by Beak Consultants. All results reported in mg/l unless noted

3.3 WATER QUALITY

Each observation well was bailed for 1-1/2 well volumes, and then sampled and analysed for major ions, phenol, total iron and COD. The surface water sources (SP1-81 and SP2-81) were frozen at the time of sampling.

The water analysis results are displayed on Table 3.2 and Table 3.3 for samples taken on October 5, 1981 and February 2, 1982 respectively. There was generally a slight decrease in most of the parameters in the February samples.

The general improvement in water quality would indicate that the wells had not equilibrated to date. In all cases the calcium readings have decreased from that of October 1981, magnesium have in general remained fairly stable or show a slight increase. Sodium and potassium concentrations have decreased as compared to October 1981. Notably, sulphate at OW2-81 has decreased from 255 mg/L in October to 4 mg/L in February. The elevated chloride concentrations noted in October 1981 are relatively stable, having a maximum of 850 mg/L at OW8-81 on October 5, 1981 and February 2, 1982. The pH has remained relatively stable. Iron has shown a significant variance between October 1981 and February 1982, notably an increase from 11.5 mg/L to 18 mg/L at OW1-81; an increase from 0.02 mg/L to 0.53 mg/L at OW8-81. The phenols have in general decreased from a high of 40 ppb in October 1981 at OW1-81 to a high of 19 ppb at OW8-81 in February 1982.

3.4 COMBUSTIBLE GAS

A total of fourteen gas monitoring probes have been installed at the site since the beginning of the field investigation. Nine of these probes (GMP1-81 to 3-81, GMP5-81 to GMP8-81, GMP11-81 and 12-81) are located within the refuse. The remaining gas probes are located outside the refuse deposit to monitor for possible methane gas migration.

The combustible gas monitoring results are presented in Table 3.4. After the first monitoring date, the concentration of methane in each of the gas probes is generally consistent. Gas probe GMP11-81 is the major exception with a range of methane from 13% to 50%. At this location the highest level of methane was also detected and the greatest increase after the ground froze. A significant increase in methane was not observed in the other gas probes during the months of January and February.

TABLE 3.4

COMBUSTIBLE GAS LEVELS

Sample Location	Monitoring Date (% Volume Methane) Oct. 5 1981	Nov. 7 1981	Dec. 8 1981	Jan. 8 1982	Feb. 8 1982
GMP1-81	0	15	15	7	17
GMP2-81	0	22	19	11	12
GMP3-81	0	22	25	16	15
GMP4-81	0	-	7	6	17
GMP5-81	0	33	28	14	22
GMP6-81	0	14	9	10	8
GMP7-81	0	0	4	9	4
GMP8-81	0	0	0	0	0
GMP9-81	0	0	0	0	-
GMP10-81	0	0	0	-	-
GMP11-81	0	25	13	50	45
GMP12-81	0	*	0	0	0
GMP13-81	0	0	0	D	D
GMP14-81	0	4	3	0	0
Valve Box	-	-	5	-	-

D - Destroyed

Two combustible gas monitors were installed by the City of Waterloo in August 1981 in the park behind Dale Crescent. These monitors have been checked regularly by city personnel and Conestoga-Rovers & Associates Limited, but no readings have been taken because these monitors have been full of water (believed to be surface water).

The valve box for the water main at the entrance to the Sewage Treatment Plant was monitored for combustible gas on December 8, 1981 and 5% methane was detected.

3.5 SUMMARY AND FUTURE WORK PROGRAM

Both surface water and groundwater flow on the site is directed to Laurel Creek.

The chemical analysis shows a range of concentrations for the chemical parameters over the site. Generally the highest concentrations of leachate are found in the area with OW1-81 to OW4-81 and at OW8-81.

Samples of groundwater for major chemistry and phenols will be collected for the third and final time in June 1982. Conclusions on the characteristics of the leachate will be made after all samples have been collected. Water level data will be compiled once each month. Recovery/slug tests will be performed on the observation wells to estimate an insitu hydraulic conductivity. These results will be compiled with rates of infiltration to estimate leachate quantity and migration/attenuation.

Moderate concentrations of methane have been detected at some of the monitors. A high concentration of methane has been detected at GMP11-81. Methane migration does not appear to pose any immediate hazard to the nearby homes or buildings at the sewage treatment plant. Gas monitoring will be continued once per month to verify this condition.

4.0 SUMMARY

This report summarizes the work conducted to date, outlines the preliminary results from the investigation and details the future work program.

The Thorold Site (No. 0044) has been extended along the old Welland Canal in the City of Thorold. This expanded field investigation was implemented by using a portable power auger and installing gas probes up to 1.5 meters below ground surface. A more detailed study along the canal is presently being conducted by Conestoga-Rovers & Associates Limited on behalf of the City of Thorold. The scope of this study is to monitor for combustible gas along sections of the canal where putrescible refuse has been reported. Special emphasis will be placed on buildings on or near these sections.

The investigation at the Grimsby Site (No. 0062) has been discontinued due to no refuse being observed or reported at this site.

The Waterloo Site (No. 0084) investigation has continued with a work program unchanged since initial field instrumentation at the beginning of the study.

The work program for the Waste Site Identification Study is proceeding on schedule. The field investigation will continue until June 1982, at which time the final progress report has been scheduled for preparation and presentation. If the field results until the completion of the study do not vary significantly from the results already observed, it is recommended that there is no need for a final progress report. The presentation of the draft of the final report would take place in the end of July 1982.

All of which is respectively submitted.

CONESTOGA-ROVERS & ASSOCIATES LIMITED

Anthony J. Crutcher, P. Eng.

William S. Clarke, B.Sc.

APPENDIX A

BOREHOLE LOGS FROM GAS-POWERED PORTABLE AUGER

THOROLD - NOVEMBER 18, 1981

BH10-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.4	Grey silty clay fill with pieces of concrete, asphalt and gravel

Comments

GMP10-81 installed 1.2 meters below ground surface.

BH11-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	1.5	Brown silty clay

Comments

GMP11-81 installed 1.4 meters below ground surface.

BH12-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	1.5	Brown silty clay

Comments

GMP12-81 installed 1.2 meters below ground surface.

BH13-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	1.5	Brown silty clay

Comments

GMP13-81 installed 1.4 meters below ground surface.

BH14-81

DEPTH From	To (meters)	DESCRIPTION
0	0.1	Topsoil
0.1	1.0	Red silty medium sand
1.0	1.4	Black sandy fill (possibly refuse)

Comments

GMP14-81 installed 1.4 meters below ground surface.

BH15-81

DEPTH From	To (meters)	DESCRIPTION
0	0.1	Topsoil
0.1	1.5	Grey clayey silt

Comments

GMP15-81 installed 1.5 meters below ground surface.

BH16-81

DEPTH From	To (meters)	DESCRIPTION
0	0.1	Gravel
0.1	1.5	Grey silty clay fill with gravel

Comments

GMP16-81 installed 1.4 meters below ground surface.

BH17-81

DEPTH From	To (meters)	DESCRIPTION
0	1.5	Grey silty clay

Comments

GMP17-81 installed 1.5 meters below ground surface.

BH18-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.5	Reddish brown silty clay

Comments

GMP18-81 installed 1.4 meters below ground surface.

BH9-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.5	Light brown silty clay

Comments

GMP9-81 installed 1.5 meters below ground surface.

BH19-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	1.5	Brown silty clay fill with gravel

Comments

GMP19-81 installed 1.5 meters below ground surface.

BH20-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	0.3	Brown silty clay fill with gravel
0.3	1.5	Black sandy fill (possibly refuse)

Comments

GMP20-81 installed 1.5 meters below ground surface.

BH21-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.1	Brown silty sand fill

Comments

GMP21-81 installed 1.1 meters below ground surface.

BH22-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.5	Red silty sand fill

Comments

GMP22-81 installed 1.4 meters below ground surface.

BH23-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Topsoil
0.1	1.5	Grey silty clay

Comments

GMP23-81 installed 1.5 meters below ground surface.

BH24-81

DEPTH		DESCRIPTION
From	To (meters)	
0	0.1	Course gravel
0.1	0.3	Black sandy fill (possibly refuse)
0.3	1.5	Brown silty clay with gravel

Comments

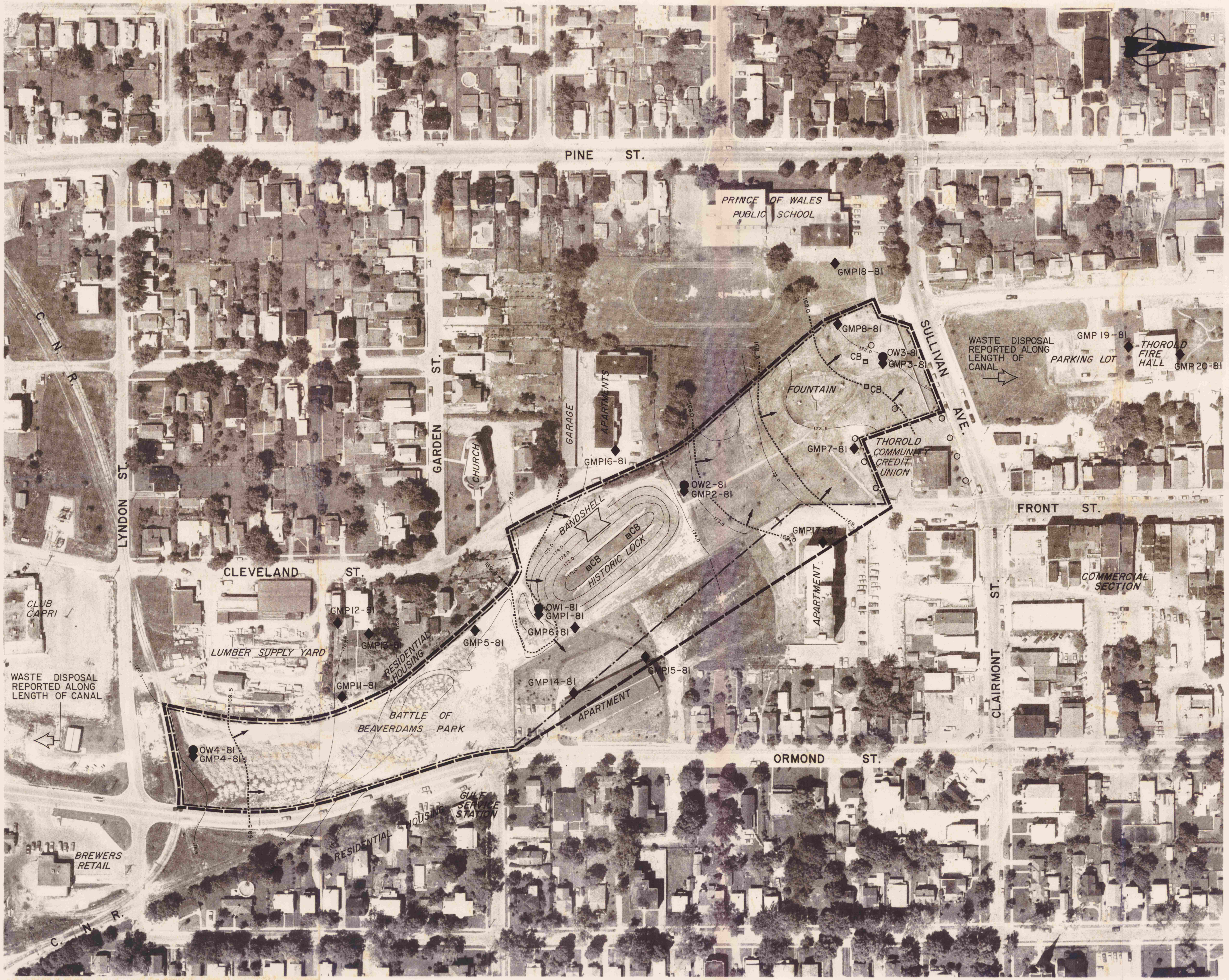
GMP24-81 installed 1.5 meters below ground surface.

BH25-81

DEPTH		DESCRIPTION
From	To (meters)	
0	1.2	Brown silty sand fill

Comments

GMP25-81 installed 1.2 meters below ground surface.



LEGEND

—·—·—	LIMIT OF REFUSE
— — —	INFERRED LIMIT OF REFUSE
▬ ▬ ▬	LIMIT OF INVESTIGATION
—176.0—	ELEVATION (m AMSL)
● OW1-81 —	OBSERVATION WELL
◆ GMP1-81 —	GAS MONITORING PROBE
▲ TH1-81 —	TESTHOLE
☒ SP1-81 —	SURFACE WATER SAMPLING POINT
→ —	DIRECTION OF GROUNDWATER FLOW
〜→···〜→···〜→	SWALE
·······169.0·······	POTENTIOMETRIC SURFACE (OCTOBER 27, 1981)
○ ——	PASSIVE GAS VENT

PHOTO BASE MAPPING PREPARED BY NORTHWAY-GESTALT CORPORATION FLOWN AT 5000' IN SUMMER 1978.

Ontario
Ministry
of the
Environment

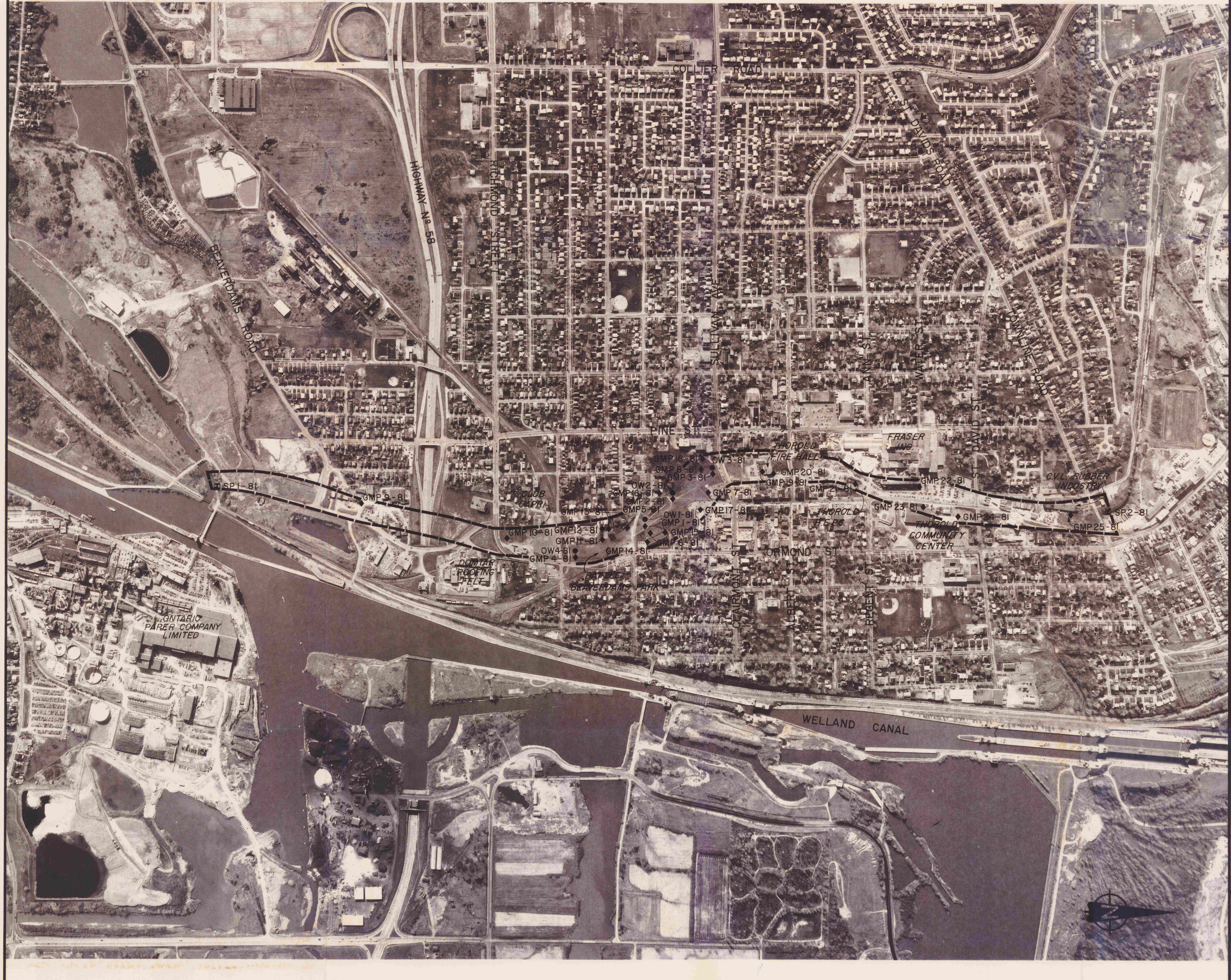
Waste Site #0044-Thorold
SITE PLAN 1

WASTE SITE IDENTIFICATION STUDY
Phase II Part I
Verification Studies
West Central Region

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

Drawn by:	Checked by:	Project Nº	Date:
G.R.H.	A.J.C.	9-0913	MARCH 4, 1982

Scale:	Drawing:
1:1000 0 10 20 30 40 50 m	map 2.1



LEGEND

● OW 1-81	OBSERVATION WELL
◆ GMP 1-81	GAS MONITORING PROBE
☒ SP 1-81	SURFACE WATER SAMPLING POINT
▬ ▬ ▬	LIMIT OF INVESTIGATION

PHOTO BASE MAPPING PREPARED BY NORTHWAY - GESTALT CORPORATION FLOWN AT 10,000' ON APRIL 16, 1981.

Ministry
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Ontario

Waste Site #0044-Thorold
SITE PLAN 2

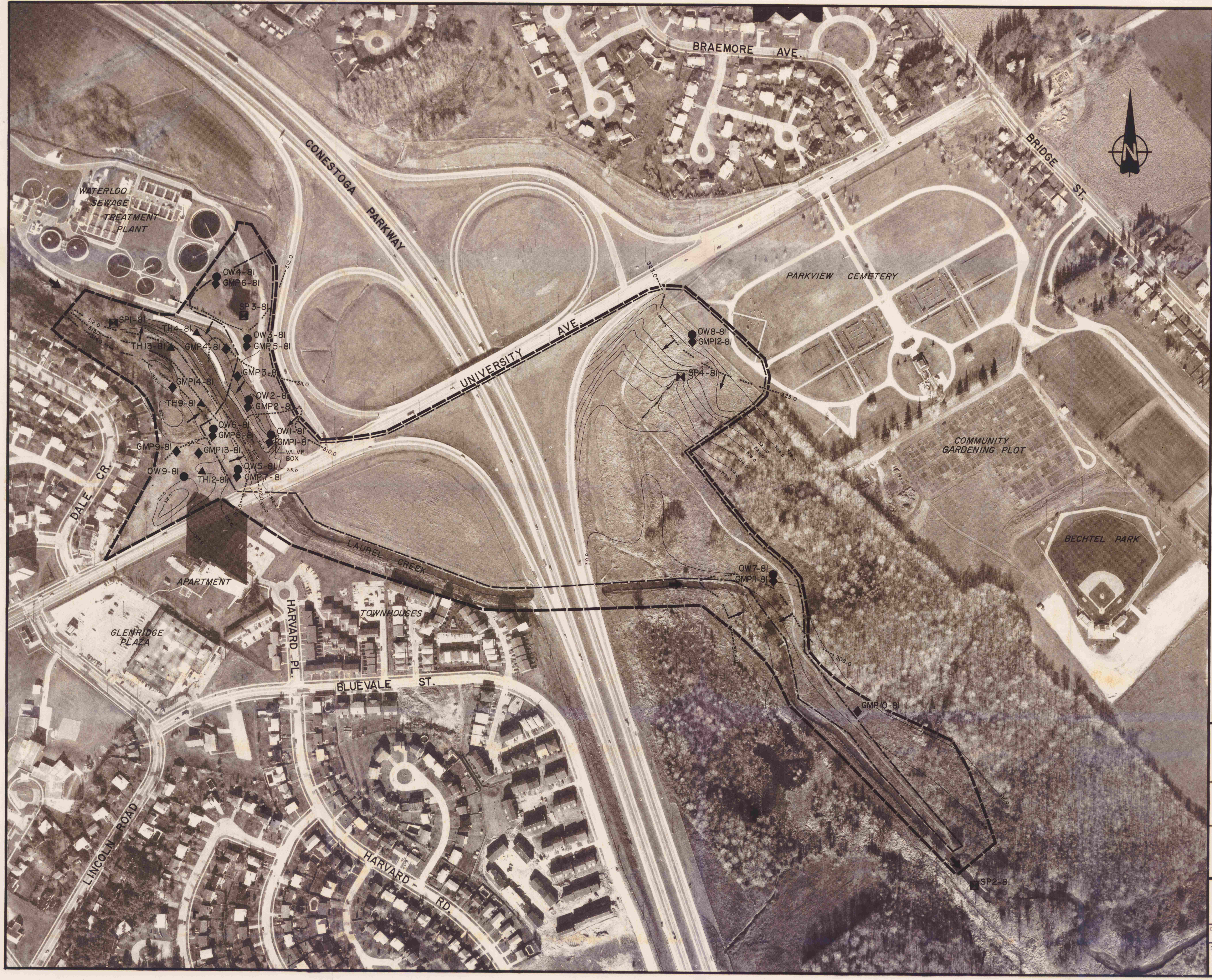
WASTE SITE IDENTIFICATION STUDY
Phase II Part I
Verification Studies
West Central Region

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

Drawn by:	Checked by:	Project Nº	Date:
G.R.B.	A.J.C.	9-0913	MARCH 4, 1982

Scale: 0 100 200 300m
SCALE: 1/5000

Drawing: **map 2.2**



LEGEND

LIMIT OF REFUSE
INFERRED LIMIT OF REFUSE
LIMIT OF INVESTIGATION
320.0 ELEVATION (m AMSL)
● OW1-81 — OBSERVATION WELL
◆ GMP1-81 — GAS MONITORING PROBE
▲ TH1-81 — TESTHOLE
☒ SP1-81 — SURFACE WATER SAMPLING POINT
→ — DIRECTION OF GROUNDWATER FLOW
SWALE
310.0 POTENTIOMETRIC SURFACE (OCTOBER 5, 1981)

PHOTO BASE MAPPING PREPARED BY NORTHWAY-GESTALT CORPORATION FLOWN AT 4000' ON NOVEMBER 12, 1979.

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of the
Environment

Waste Site #0084 - Waterloo
SITE PLAN

WASTE SITE IDENTIFICATION STUDY
Phase II Part I
Verification Studies
West Central Region

CRA Consulting Engineers
CONESTOGA-ROVERS & ASSOCIATES LIMITED
651 Colby Drive, Waterloo, Ontario Canada N2V 1C2

Drawn by:	Checked by:	Project Nº	Date:
G.R.H.	A.J.C.	9-0913	MARCH 4, 1982

Scale: 1:2000

0 10 30 50 100 m

Drawing: map 3.1

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1982

Progress report no.2 : waste site
identification study phase II,
part II verificationi studies.

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